1100

Food Research at the Eastern Utilization Research Branch

Norman E. Roberts
Eastern Utilization Research Branch, Agricultural Research Service, U. S. Department of Agriculture, Philadelphia 18, Pennsylvania

IN THE SUMMER OF 1940, the doors of the Eastern Regional Research Laboratory of the U. S. Department of Agriculture, in Wyndmoor, Pennsylvania (near Philadelphia), first opened. It was one of four laboratories established simultaneously to find new and profitable uses for agricultural commodities. The others likewise took their names from the agricultural regions they were intended to serve; the Northern in Peoria, Illinois, the Southern in New Orleans, Louisiana, and the Western in Albany, California.

These four laboratories are known today as the Utilization Research Branches of the Agricultural Research Service. The research conducted in these Branches is seeking both new industrial uses and new food uses for agricultural commodities. In the food field much of the effort has been directed to the development of new items and to an improvement in the quality or a decrease in the cost of existing foods.

The Eastern Utilization Research Branch is administered by Dr. P. A. Wells, who has been head of the Wyndmoor laboratory since its beginning. The Branch now embraces, in addition to the Eastern Regional Research Laboratory, laboratories in the South Building of the Department of Agriculture in Washington, D. C., and at the Agricultural Research Center, in Beltsville, Maryland.

Broadly, the food program of the Eastern Utilization Research Branch could be divided into three large areas; (1) Eastern fruits and vegetables, and special crops; (2) dairy products; and (3) meat and other livestock products.

Fruits and vegetables. The program of the Eastern Branch on fruits and vegetables ranges from a detailed scientific analysis of the components of fruits and vegetables and similar work of a fundamental nature, to the development of new food products and their production on a small scale in the laboratory's well-equipped pilot plant.

On the fundamental side, for example, there is the study of the red sour cherry, which is designed to find out why this popular pie fruit loses its appealing bright color in a relatively short time after canning.

The minor constituents of fruits and vegetables—those present in such minute quantities that they could not be accurately determined by earlier analytical methods—are under study at the Eastern Branch by

The Eastern Regional Research Laboratory, Wyndmoor (near Philadelphia), Pa., headquarters of the Eastern Utilization Research Branch of the USDA's Agricultural Research Service. Inset is Dr. P. A. Wells, Chief of the Branch.

such methods as chromatography and infrared and ultraviolet spectrophotometry. This work is revealing that some of these components of fruits and vegetables have important effects on their processing quality.

Eastern Branch chemists have been interested in what makes for consistency in processed tomato products.

Eastern Branch apple juice powder is kept dry by means of an in-package desiccant, in the small envelope in the center foreground.

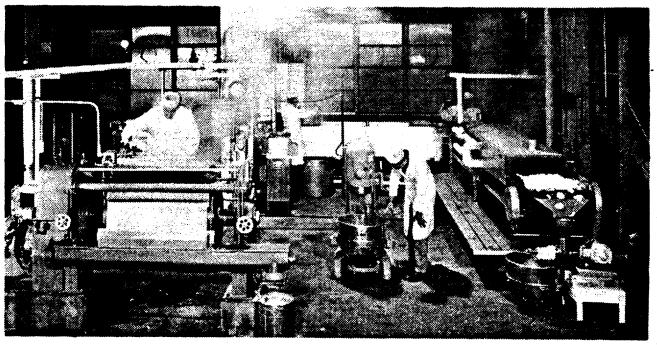
Not sure that the amount of pectic compounds is the only, or even the main, factor in regulating consistency, they have noted vast differences in juices made from different parts of the tomato, which had essentially the same solids and pectic content. These studies have indicated that chemical composition is not so important to juice consistency as the quantity of tomato cell walls present, the presence or absence of pectins in the walls, and the structural arrangement of the walls.

On the applied side, various new products are continually being developed at the Eastern Branch and brought to the point of production feasibility in the Branch's pilot plant. In 1944 a process was developed for making full-flavored apple juice concentrate by recovering the volatile flavor of the apples during processing, concentrating it, and then restoring the recovered and concentrated flavor to the concentrated juice. This basic development, called "essence recovery," is of great importance because it permits the recovery of the volatile flavoring constituents that impart the fresh character to the fruit. These volatiles were previously largely lost during processing. This development opened the way for the economical production of many volatile fruit essences, which are used to restore the flavor to concentrates. They are also used to fortify the flavor of other food products such as ice cream, candy, and beverages, and are incorporated in certain flavoring extracts. The process has been applied to grapes, peaches, strawberries, red raspberries, cherries, blackberries, and low-bush blueberries. Apple, cherry, and grape juice powders, produced by a batch process on a pilot-plant scale have successfully withstood room temperature storage tests for over a year without significant flavor or quality loss. A continuous process is now under development to make these powders.

One of the Eastern Branch's latest developments is a new and different form of dehydrated mashed potato called "potato flakes." These flakes are made by drying mashed potatoes in a thin sheet on drum driers and then breaking the sheet into flakes. The process employs a single stage drying step, and the drying time is short (less than 30 seconds). Therefore the potato flavor is retained and a subtle baked-potato flavor is added. Because only a minimum of damage to the cellular structure of the potato occurs, the flakes reconstitute with hot water and milk to mealy, fluffy mashed potatoes.

From the standpoint of the economic utilization of an agricultural commodity often in serious surplus, potato flakes are a promising development. They can be made with lower-solids-content potatoes from the East and other regions as well as from Idaho Russets which are used almost exclusively in other forms of dehydrated mashed potatoes. Also, the process can use single-drum driers, generally available in potato flour plants.

Potato-chip manufacturers can now offer to the public a completely new line of wholesome and nutritious snack items as a result of research at the Eastern Branch on the deep-fat frying of vegetables. Details of processes for making chips from sliced carrots, beets, and parsnips, and "nuggets" from whole peas and lima beans, have been worked out. The chips retain the characteristic flavor of the vegetable from which they were made; the nuggets have a unique nutlike flavor. The nuggets also can be ground into soup powders that reconstitute quickly in hot water. Along with the development of these new products, research to improve the quality of the time-honored potato chip is also carried on at the Eastern Branch.



Pilot plant equipment for producing potato flakes. The sliced potatoes are cooked in the steam-tunnel at the right as they move along the conveyor, and after cooking are riced and stabilized by addition of antioxidant (right center). The potatoes are then spread on a steam-heated drum drier and come off the drier in a thin sheet which is broken into flakes (left center).

Maple and honey. Maple and honey are two special crops of considerable agricultural significance on which work is done at the Eastern Branch. Maple processing, from the tapping of the trees to the manufacture of maple sirup, candies, and other products, is intensively studied, with the result that farmers are realizing more from their maple crops and consumers are provided

with new, improved, and more economical maple delicacies. Honey research has developed new uses for this sweetening agent, especially in the field of baked products. The constituents of honeys from different floral sources are now being determined by modern analytical techniques.

Dairy products. The Department of Agriculture's utilization research program on milk and other dairy products is concentrated in the Eastern Branch. It is a well-balanced program of both basic and applied studies. The milk-processing pilot plant at Washington did pioneer work in the development of a high-temperature, short-time method of sterilizing evaporated milk. A whole milk powder is under study, new uses for skim milk and whey are in development, and a small-scale bakery evaluates the effectiveness of milk products for baked goods.

L. V. Rogers of the Branch's Dairy Products Section demonstrates research on the effect of dried milk solids on bread. Here he is measuring the volume of a loaf by displacement of small seeds.

The total solids content of a milk sample can now be determined precisely without drying it to constant weight, thanks to a new lactometer, developed at the Eastern Branch, which measures the specific gravity of milk at 102° F. At this temperature the fat is completely in a liquid state and thus cannot affect the accuracy of the measurement.

Research on the spreadability and flavor of butter and on the making of many types of cheese is another important part of the Eastern Branch's dairy program. Developments in this field include a new, short-time method of making Cheddar cheese using conventional equipment.

Such practical developments as these are necessarily dependent upon basic research findings. For a number of years the proteins of milk, especially casein, the principal protein, have been studied at the Eastern Branch with highly interesting and significant results. An analysis of the effect of heat on milk has yielded information of value in the field of milk sterilization. The colloidal properties of fat-free milk have been studied using the ultracentrifuge, and this work has clarified many of the changes that take place in manufacturing evaporated milk.

Meat. Meat research at the Eastern Branch is concerned with a number of problems relating to the quality of meat and processed meat products. The perishability of cured meats has led to a study of farm and locker plant methods for curing and storing pork. Improved curing methods have been developed as a result of this research, but more data are being sought on such points as the mechanism of aging and the role of native enzyme systems and microorganisms during curing and storage.

The muscle components of meat are being studied in connection with comminuted products such as sausage. These components have been linked to the "binding" properties of meat which are important for retention of moisture, adherence of components, and juiciness and tenderness in such products.

Beef tenderness is another important field of research at the Eastern Branch. The problem is to take full advantage of the tenderizing effect of aging on lower grades of beef without encountering microbial growth. Among the experiments being tried are ultraviolet radiation to reduce contamination by microorganisms, use of higher aging temperatures, and infusion of carcasses with antibiotics and enzymes. Other qualities desirable in meats, such as juiciness, aroma, flavor, and color, are being studied from the standpoint of the individual meat components which contribute to these qualities.

The Eastern Branch is carrying on an extensive program of research on animal fats. Most of this work is concerned with the use of inedible fats in industrial applications. A part, however, is designed to improve the physical characteristics of lard and other meat fats especially for use in baked products. By means of photomicrography, basic studies are being made on the crystal habit of lard and rearranged lard. This work is expected ultimately to place meat fats in a better competitive position with respect to vegetable shortenings. The Branch is also cooperating in an effort to establish the role of dietary fats in nutrition.

CONCLUSION

Thus, on many food fronts, the utilization research of the U. S. Department of Agriculture, and specifically that of the Eastern Branch, is finding new outlets for the farmer's commodities, providing the food processor with profitable items for manufacture and sale, and widening the consumer's choice of available foodstuffs.